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ABSTRACT

Students' ability to use self-regulatory learning skills is becoming increasingly important with the advent of World Wide Web-based learning. Online courses delivered through the Web require students to take more ownership over how and when learning takes place, rather than tutors and lecturers making these decisions. This comes at a time when higher education institutions have increasing pressure to develop students' lifelong learning and generic skills from both employers and funding authorities. This paper investigates a conceptual framework for identifying students' self-regulatory skills and considers LASSI (the Learning and Study Strategies Inventory), a testing instrument to identify students' strengths and weaknesses. The instrument can be administered online, and a full analysis of the results is immediately returned to both student and tutor. From the 77 items used, a subset of these is selected and mapped to the six dimensions defined in the conceptual framework (i.e., metacognition, self concept, self monitoring, motivation, strategy formation, and volition control strategies). The conceptual framework and associated questions related to each of the defined dimensions provides a quick and convenient tool for assessing students' self-regulatory skills. This mapping can help educators provide assessment and timely feedback to students at a time when there is a pronounced emphasis in higher education to provide skills and competencies that can be transferred to the workplace. (Contains 20 references.) (Author/MES)

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ASSESSING STUDENTS' SELF-REGULATORY SKILLS

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Abstract

Students' ability to use self-regulatory learning skills is becoming increasingly important with the advent of web-based learning. Online courses delivered through the Web require students to take more ownership over how and when learning takes place, rather than tutors and lecturers making these decisions. This comes at a time when higher education institutions have increasing pressure to develop students' life long learning and generic skills from both employers and funding authorities.

In this paper we will investigate a conceptual framework for identifying students' self-regulatory skills and consider a testing instrument to identify students strengths and weaknesses. The instrument can be administered online, from which a full analysis of the results is immediately returned to both student and tutor. From the 77 items used, a subset of these are selected and mapped to the six dimensions defined in the conceptual framework.

The conceptual framework and associated questions related to each of the defined dimensions, provides a quick and convenient tool for assessing students' self-regulatory skills. This mapping can help educators provide assessment and timely feedback to students at a time when there is a pronounced emphasis in higher education to provide skills and competencies that can be transferred to the workplace.

Keywords
self-regulation, generic skills, higher education

Introduction

Over the past few years there has been increasing pressure on higher education institutions from employers and funding authorities to promote the development of students' generic skills. From the many reports written about these, it is often difficult to obtain a consistent set of required generic skills across different institutions/authors. There is however, a consistent demand for graduating students to have life long learning skills that enable learners to continually upgrade their skills and knowledge through their own self-motivation and learning skills (Australian National Training Authority, 1998; Bennett, Dunne & Carre, 1999; Candy, Crebert & O'Leary, 1994; Dearing, 1997; Mayer, 1992).

An important aspect for achieving this goal is to help students take more responsibility for managing their own learning by helping them become more strategic learners. Biggs (1999) argues that there are certain limits to what certain students can achieve, and these are beyond the teacher's control, however good teaching practice can narrow this gap "good teaching is getting most students to use higher order cognitive level processes that the more academic students use spontaneously" (Biggs, 1999, p. 4). The challenge for educators then is to find teaching and

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learning methods that bridge this gap, which include valid assessment and feedback instruments to help students locate their strengths and deficiencies. With the pressure of employers, funding authorities and now the advent of online learning for a greater proportion of students, tertiary educators must now determine how best to foster self-regulated learning amongst students. Loomis (2000) contends that it is hardly surprising that there is a high dropout rate for students with poor study skills when they venture onto online courses. Brooks (1997) goes so far as to claim that students "who are poor at self-regulation easily can be slaughtered in www-based courses" (p. 135). While it cannot be denied that the Web has the capability to be an efficient and flexible environment for users to meet their own learning goals, a necessary first step would appear to be the identification of students who may potentially be at risk of failure in such environments through the lack of self-regulatory skills.

This paper will examine the nature of self-regulation, and the enabling attributes that underpin this ability. In order to assess students' self regulatory skills, a subset of items from an existing validated instrument is proposed. LASSI, a tool for assessing students study habits will be analysed in terms of its potential to assess underpinning attributes for self-regulation.

A Definition of Self-regulation

Self-regulation is somewhat easier to define than understand. It has been described as 'the process whereby students activate and sustain cognitions, behaviours, and affects, which are systematically oriented toward attainment of their goals' (Schunk & Zimmerman, 1994, cited by Boekaerts, 1997, p. 171). This definition is reinforced by Brooks (1997) who argues that it is active and goal directed, resulting from self control of behaviour motivation and cognition. This emphasis on multiple constructs places self-regulated learning at the junction of several fields of research (Boekaerts, 1997). It emphasises students' reliance on their own internal resources to govern their learning, but these resources are not easy to delineate. Self-regulated behaviour is an end process, dependent upon the affects and cognitions that precede it. These are to a certain extent inaccessible, since they are internally constructed and not always explicitly articulated by individuals.

Also, the notion of self-regulation is prone to multiple interpretations based upon educational philosophy. Zimmerman (1989) identifies it in terms of phenomenological, social cognitive, volitional, Vygotskian and cognitive constructivist theories. All of these approaches bring a unique framework to the concept. Behaviourist approaches emphasise self-monitoring, self-instruction and self-reinforcement, while a phenomenological approach defines it in dimensions such as self-worth, planning, and goal setting. Common to most of these however, is an acknowledgment of the interaction of affective and cognitive processes at a level of abstraction. Self-awareness at a cognitive and emotional level would appear to be the key enabling process in the development of self-regulatory strategies.

A Model of Self-regulation

A number of models have been developed to explain the processes that underpin self-regulated learning. Boekaerts (1997) provides a six component model based upon the following notions:

- Content domain
- Cognitive strategies
- Cognitive regulatory strategies
- Metacognitive knowledge and motivational beliefs
- Motivational strategy use
- Motivational regulatory strategies.

These elements are co-dependent and interact with each other in the application and development of goals, strategies and domain-specific knowledge.

Garcia and Pintrich (1994) articulates self-regulation in terms of knowledge and beliefs, strategies used, and outcomes. Each of these is moderated by motivational and cognitive components such as personal beliefs and conceptual knowledge, motivational and cognitive strategies, and quantity and quality of effort. Common to both models is an integration of both affective and cognitive issues:

> Neither motivational nor cognitive models alone can fully describe the various aspects of student academic learning, yet the two types of models are complementary due to the respective strengths and weaknesses of motivational and cognitive models (Garcia & Pintrich, 1994, p. 127)

Figure 1 represents a synthesis of the above frameworks. It accommodates the role of both affective and cognitive aspects of self-regulation, but also acknowledges the effects of external environmental factors upon an individual's ability to regulate their learning. Self-regulation is viewed here as the intersection of self-awareness at both a rational and emotional level. Metacognition and self concept are seen as the primary enabling process in this model, with self-monitoring and motivation as subordinate processes which are involved in the development of cognitive and motivational strategies.

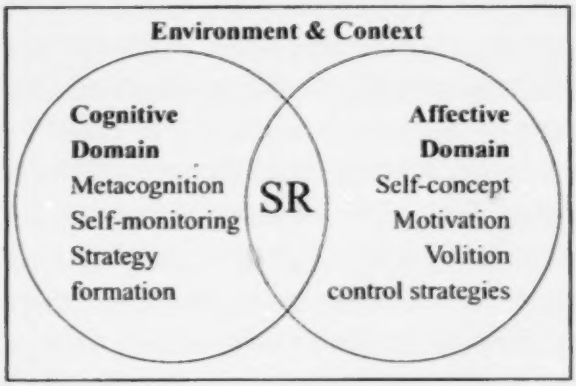

Figure 1: Conceptual framework

LASSI – The Learning and Study Strategies Inventory

Weinstein, Palmer and Schulte (1987) developed the Learning and Study Strategies Inventory (LASSI) over ten years ago and it is currently used by almost 2000 tertiary institutions over the world (online). It was developed as an diagnostic tool to measure how students use learning strategies in academic environments, so they can be strengthened through interventions. "It is designed to gather information about learning and study practices and attitudes based on 77 statements related to learning and studying" (Weinstein, Palmer & Schulte, 1987, p. 2). It provides assessment in ten learning and studying scales as follows:

- Attitude towards studying and motivation for success
- Motivation, diligence, self-discipline, and willingness to work hard
- Use of time management principles for academic tasks
- Anxiety and worry about school performance
- Concentration and attention to academic tasks
- Information processing, acquiring knowledge, and reasoning
- Selecting main ideas and recognizing important information
- Use of support techniques and materials
- Self-testing, reviewing, and preparing for classes
- Test strategies and preparing for tests

These LASSI scales are administered through either paper-based, floppy disk or web-based testing, in which students are generally given both pre- and post-tests to test their progress. In many instances, after the pre-test, students are given advice about how to improve their performance if they scored below the 50th percentile. An example of the type of feedback that can given to students is demonstrated in Table 1 (Haught, Hill, Walls & Nardi, 1998). This feedback can be structured so that it is more directed and customised for all students in order to give them greater scaffolding/ assistance in developing these skills. Depending on what score or percentile was obtained on each of the scales, different levels of assistance could be suggested to encourage self-improvement. Other resources are available to assist tutors in giving students feedback, based on the LASSI scores. Bogue (1993) has published a book based on each of the LASSI learning characteristics and gives suggestions as to what students can do to improve skills in each of these areas.

Scale	**Suggestions for students who scored low on this measure**
Attitude	Work on higher level goal setting and reassess how school fits into your future
Motivation	Work on goal setting for individual tasks and assignments
Time Management	Learn how to create a schedule and to deal with distractions, competing goals, and procrastination
Anxiety	Learn techniques for coping with anxiety and reducing worry so you can focus on the task and not on anxiety
Concentration	Learn techniques to enhance concentration and set priorities by focusing attention on the task at hand and eliminating interfering thoughts, emotions, feelings, and situations
Information Processing	Learn methods that you can use to help add meaning and organization to what you are trying to learn
Selecting Main Ideas	Learn more about how to identify important information so that you can focus attention and information processing strategies on appropriate material
Study Aids	Learn more about the types of study aids provided in educational materials and how you can create your own aids
Self Testing	Learn more about the importance of self-testing and need to learn specific methods to review school material and to monitor your comprehension
Test Strategies	Learn more about how to prepare for tests, how to create a plan of attack for taking a test, the characteristics of different types of tests and test items, and how to reason through to an answer

Table 1: LASSI subscales-low score suggestions offered to students

As well as using the LASSI instrument to give students direct feedback on these ten scales, other researchers have used LASSI to create latent variables as a basis for their educational research. Olejnik and Nist (1992) created three tacit variables based on the LASSI scales as part of their research. They identified "*Effort*", which was related to activities based on motivation, time management, and concentration; "*Goal Orientated*" activities based on the anxiety, test strategies, and selecting main ideas subscales; and "*Cognitive*" activities based on information processing, study aids, and self-testing subscales.

After students complete the LASSI test (through online administration), they immediately receive feedback about their results. As shown in Figure 2, the results clearly show students their strengths and weaknesses in areas related to strategic learning. Tutors also have access to all of these, which they use to help provide advice and support to students in areas of weakness.

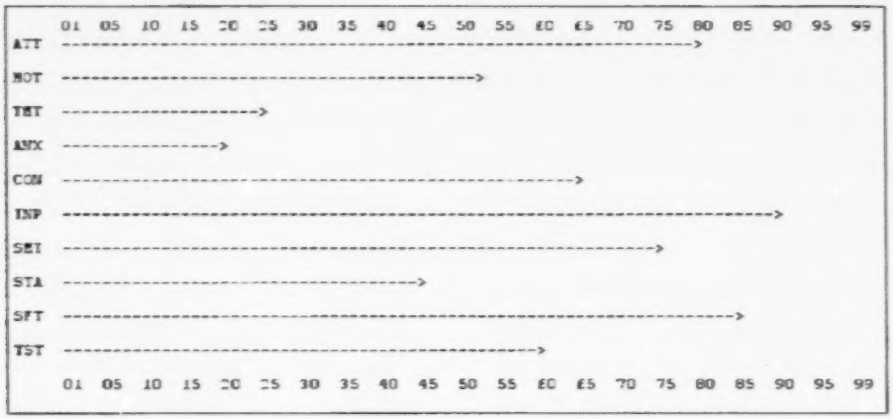

Figure 2: Sample LASSI feedback

LASSI as a Tool for Assessing Self-regulation

The LASSI subscales listed in Table 1 offer some insight into commonalities between the inventory and the model for self-regulation proposed. Motivation, for example, is an element that is integral to both. This does not mean, however, that the two can be seen as synonymous. The use of study aids, for example, is essential to self-regulated learning, but it does not mean that those students who use aids are necessarily capable of regulating their own learning, since these may simply be received aids and not conscious process of strategy formation. In contrast, students' creating their own aids is a more likely indication of the metacognitive and self-monitoring processes that underpin self-regulatory processes.

Therefore care needs to be taken to select items that are integral to the concept of self-regulation and remove those that are extraneous. What follows is an analysis of inventory items, identifying those which best appear to represent self-regulatory processes. While an element of subjectivity must be acknowledged in this process, a rationale is provided for why items have been classified in particular ways, and why others have been discarded entirely.

Analysis of LASSI Items

Items that assess Metacognition.

- I try to see how what I am studying would apply to my everyday living
- I try to find relationships between what I am learning and what I already know
- I try to relate what I am studying to my own experiences
- I try to interrelate themes in what I am studying

Metacognition can be defined as "knowledge and beliefs about thinking and the factors affecting thinking" which regulate "the articulation of strategy and knowledge" (Pressley, Van Etten, Yokoi, Freebern & Van Meter, 1998, p. 347). As such it is a necessary precursor to self-regulation. Flavell (cited in Boekaerts, 1987) identifies three types of metacognition: knowledge of self, knowledge about various cognitive tasks and strategy knowledge. All of the items above identify aspects of cognitive self awareness, whether based around the ability to abstract from specific to general situations or to articulate new knowledge in terms of concepts that are already understood.

Items that assess Self Concept

- I worry that I will flunk out of school
- When I begin an examination, I feel pretty confident that I will do well
- Worrying about doing poorly interferes with my concentration on tests

- I get so nervous and confused when taking an examination that I fail to answer questions to the best of my ability

When one considers that students who do not see themselves as 'smart' or able enough often adopt self-handicapping strategies or overcompensate with effort (Brooks, 1997), the centrality of self-concept to self-regulation is immediately apparent. The above items identify issues of self-awareness at an affective rather than cognitive level. Fear of failure and a general lack of confidence can breed intellectual defensiveness which can in turn hinder the development of self-regulatory skills.

Items that assess Self Monitoring

- I am up-to-date in my class assignments
- I compare class notes with other students to make sure my notes are complete
- I review my notes before the next class
- I test myself to be sure I know the material I have been studying

Self monitoring is a process that is dependent upon a level of metacognition since it involves students actively assessing their own performance. Whether viewed in terms such as cognitive self observation, Vygotskian inner speech or behaviourist self recording (Zimmerman, 1989), the ability to monitor one's own performance, plan, and compare with others, are key underpinning processes to the development of self-regulatory strategies.

Items that assess Motivation

- I would rather not be in school
- I only study the subjects I like
- When work is difficult I either give up or study only the easy parts
- I tend to spend so much time with friends that my coursework suffers

Motivation results from the actualisation of Self Concept, and the ability to maintain it is one of the main tenets of Self-regulation (Zimmerman, 1994). Difficulty in sustaining interest in learning can often be attributed to poor self concept, which may result from a number of factors, including poor appraisals from teachers (Boekaerts, 1997) but is manifest by a generally weak attitude towards a learning situation. Therefore, students with poor motivation will articulate a preference for other activities, and a reluctance to approach problems which may prove to be too challenging.

Items that assess Strategy Formation

- I make drawings or sketches to help me understand what I am studying
- I learn new words or ideas by visualizing a situation in which they occur
- I translate what I am studying into my own words
- When I study, I have trouble figuring out just what to do to learn the material

Cognitive learning strategies include rehearsal, elaboration, and organisational strategies, as well as memorization through clustering, imagery, use of mnemonics and so on (Weinstein & Mayer, 1986). As well as making sketches, and visualizing practical applications, deeper cognitive processes (such as transformation - the creation of something new out of existing information) are more successful than ones which engage in knowledge as a static entity, such as rehearsal (Risemberg, 1996). Strategy formation must come from the user rather than be dictated by the curriculum. If a student is unable to 'figure out' what to do to learn new material, it is indicative of an inaibility to form strategies.

Items that assess Volition Control Strategies

- Even when study materials are dull and uninteresting, I manage to keep working until I finish
- When it comes to studying, procrastination is a problem for me
- When I decide to study, I set aside a specific length of time and stick to it
- I concentrate fully when studying

Volition differs from motivation in that motivational processes mediate the formation of and promote decisions, while volitional processes enact and protect them (Corno, 1994). Therefore motivational self-regulation is dependent upon strategies that activate effort to achieve learning goals (Garcia & Pintrich, 1994). There are several strategies that students use to control effort. In a general sense, being able to avoid distractions and procastination can assist in students' staying on task, while more specific approaches such as setting aside specific lengths of time (sometimes combined with reward mechanisms) ensure the regulation of students' effort.

Items that do not fit the model of Self-regulation

In the process of analysing the items that make up the LASSI questionnaire, many have been discarded. This is for a number of reasons. Some items are difficult to neatly categorise. The statement 'My mind wanders a lot when I study' would appear to measure a learner's lack of perseverence, but does not necessarily relate to volition control strategies per se. To claim 'I get discouraged because of low grades' may indicate a poor self concept, but the factors for this may primarily be external to the learner.

Some items, too, are open to multiple interpretations. The item, 'I have difficulty identifying the important points in my reading' may suggest poor literacy rather than poor strategy formation. One also needs to be careful when generalizing from statements such as 'I don't care if I finish school as long as I find a husband/wife'. It is tempting to interpret low self concept from such a statement, but there may be cultural or financial reasons to which the assessor needs to be sensitive. Ultimately, the process of distilling a pool of 77 items into 6 categories is a subjective one. A deliberately cautious approach has been adopted here. While many of the discarded items may still validly be used to assess self-regulation where there is any perceived potential for ambiguity they have been discarded.

Summary and Conclusions

With the advent of online learning and the push for life long learning, there is currently much debate focused on creating optimal conditions in learning environments for self-regulated learning, to help students develop as independent learners. However, providing appropriate learning environments and valid assessment instruments to monitor students' ability to self-regulate, as well as feedback and scaffolding on how to improve, is not an easy task for most tertiary educators.

This paper has provided a conceptual framework to help identify students' self-regulatory skills, as well as a mapping to a validated online testing instrument. It is our contention that this can form the basis of a pre-test, which could be administered to groups of students at the beginning of the semester, followed by customised feedback to each student with scaffolding to help raise their awareness and skills in areas of deficiency. A post-test could also be administered to help students reflect on their progress during the semester.

The test is not perfect. One important aspect of self-regulation is the influence of external factors. Some external attributes are hinted to in the LASSI instrument (for example low grades as a basis for poor self concept), and there is one statement which would certainly appear to directly tackle this issue: 'Problems outside of school – being in love, financial difficulties, conflict with parents, etc. – cause me to neglect my school work'. Nevertheless, LASSI is primarily a tool for assessing individual learning styles and does not directly accommodate external influences. It must therefore be acknowledged that LASSI test items may best be used to assess the internal processes that influence self-regulation rather than factors external to the individual learner. However, for the most part LASSI would appear to be an ideal tool for assessing the self-regulatory skills that are so crucial to students' success in an on-line environment. If this modified assessment tool does prove to be valid, it may be a more appropriate solution to purchase LASSI and use it for these purposes rather than to attempt to create a totally new instrument, that would need to be tested and validated.

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